

Notice of Allowability

Application No.

10/694,465

Examiner

Shambhavi Patel

Applicant(s)

GALLATIN ET AL.

Art Unit

2128

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 8/20/2007.
2. ☒ The allowed claim(s) is/are 1-33.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.


Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached.
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☒ Interview Summary (PTO-413),
Paper No./Mail Date _____
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____


KAMINI SHAH
SUPERVISORY PATENT EXAMINER

Art Unit: 2128

DETAILED ACTION

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on **20 August 2007** has been entered.

2. Claims 1-33 have been presented for examination.

Response to Arguments

3. In view of the amendments and arguments submitted by Applicant, the 35 U.S.C. 103 rejection is withdrawn.

Examiner's Amendment

4. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Robert Curcio on 19 September 2007.

5. Please replace lines 7-18 of page 1 of the specification with the following:

The present application is related to commonly assigned U.S. patent application Serial No. 10/694465, titled "EXTENDING THE RANGE OF LITHOGRAPHIC SIMULATION INTEGRALS, U.S. patent application Serial No. 10/694473, titled "IMPROVEMENT OF PERFORMANCE IN SECTOR-BASED OPC ENGINE UTILIZING EFFICIENT POLYGON PINNING METHOD AND SIMULTANEOUS COMPUTATION OF MULTIPLE SAMPLE POINTS", U.S. patent application Serial No. 10/694339, titled "RENESTING FLAREMAP

Art Unit: 2128

INTO DESIGN FOR EFFICIENT LONG-RANGE FLARE CALCULATION", and U.S. patent application Serial No. 10/694299, titled "PARALLEL COMPUTATION OF MULTIPLE POINTS ON ONE OR MULTIPLE CUT LINES", filed on even date herewith, which are hereby incorporated by reference herein in their entirety.

6. Please amend the claims as follows:

1. A method of generating a corrected phase map by performing model-based optical proximity correction comprising:

embedding wavefront information on a first two-dimensional complex array having a plurality of array elements and an assigned diameter;

generating a phase map from said wavefront information;

computing a point spread function from said phase map;

performing optical proximity correction calculations that account for higher order aberrations to accommodate flare or spatial frequency of approximately greater than or equal to 2μ using said point spread function; and

generating a data file containing a transformed array of said corrected phase map having said optical proximity correction.

26. A method of generating corrected phase maps for a lithographic mask by performing model based optical proximity correction on said lithographic mask pattern incorporating said phase maps comprising:

incorporating a point spread function array in real dimension within a set of convolution kernels;

Art Unit: 2128

computing an aerial image with higher order aberrations to accommodate flare or a spatial frequency of greater than or equal to 2μ using said set of convolution kernels; and
generating a data file containing a transformed array of said corrected phase maps having optical proximity corrections.

27. A program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform method steps for performing model-based optical proximity correction, said method steps comprising:

embedding wavefront information on a first two-dimensional complex array having a plurality of array elements and an assigned diameter;
generating a phase map from said wavefront information;
computing a point spread function from said phase map;
performing optical proximity correction calculations that account for higher order aberrations to accommodate flare or a spatial frequency of ~~approximately~~ greater than or equal to 2μ using said point spread function; and
generating a data file containing a transformed array of said corrected phase map having said optical proximity correction.

31. A method of performing model-based optical proximity correction on a VLSI layout mask with a lithographic process model having a phase map with higher-order aberrations comprising:

inputting an uncorrected VLSI layout mask;
inputting a lithographic process model;
embedding wavefront information having higher order terms on a first two-dimensional complex array having a plurality of array elements and an assigned diameter;

generating a phase map having higher order terms from said wavefront information;
computing a point spread function from said phase map having higher order terms that accommodate flare or a spatial frequency of approximately greater than or equal to 2μ ;
incorporating and correcting said phase map with said point spread function within the lithographic process model;
performing optical proximity correction on said uncorrected VLSI layout mask using said lithographic process model having said corrected phase map having higher order aberrations; and
outputting a data file containing a transformed array of a corrected VLSI layout mask.

32. A method of simulating wafer image for a VLSI layout Mask with a lithographic process model having a phase map comprising higher-order aberrations comprising:

inputting a VLSI layout mask;
inputting a lithographic process model;
embedding wavefront information having higher order terms on a first two-dimensional complex array having a plurality of array elements and an assigned diameter;
generating a phase map having higher order terms from said wavefront information to accommodate flare or a spatial frequency of greater than or equal to 2μ ;
computing a point spread function from said phase map having higher order terms;
incorporating and correcting said phase map within the lithographic process model;
performing simulation on said VLSI layout mask using said lithographic process model having said corrected phase map having higher order aberrations; and
outputting a data file of containing a transformed array including simulated contours from said VLSI layout mask.

Art Unit: 2128

33. A program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform method steps for a model-based optical proximity correction on a VLSI layout Mask with a lithographic process model having a phase map with higher-order aberrations comprising:

- inputting an uncorrected VLSI layout mask;
- inputting a lithographic process model;
- embedding wavefront information having higher order aberrations on a first two-dimensional complex array having a plurality of array elements and an assigned diameter;
- generating a phase map having higher order aberrations from said wavefront information to accommodate flare or a spatial frequency of greater than or equal to 2μ ;
- computing a point spread function from said phase map having higher order aberrations;
- incorporating and correcting said phase map with said point spread function within the lithographic process model;
- performing optical proximity correction on said uncorrected VLSI layout mask using said lithographic process model having said corrected phase map having higher order aberrations;
- and outputting a data file containing a transformed array of a corrected VLSI layout mask.

Allowable Subject Matter

7. Claims 1-33 are allowed.
8. The following is an examiner's statement of reasons for allowance:

Regarding claims 1 and 27:

Art Unit: 2128

The prior art of record does not disclose “performing optical proximity correction calculations that account for higher order aberrations to accommodate flare or spatial frequency of greater than or equal to 2μ using said point spread function.”

Regarding claim 26:

The prior art of record does not disclose “computing an aerial image with higher order aberrations to accommodate flare or a spatial frequency of greater than or equal to 2μ using said set of convolution kernels.”

Regarding claim 31:

The prior art of record does not disclose “computing a point spread function from said phase map having higher order terms that accommodate flare or a spatial frequency of greater than or equal to 2μ .”

Regarding claims 32 and 33:

The prior art of record does not disclose “generating a phase map having higher order terms from said wavefront information to accommodate flare or a spatial frequency of greater than or equal to 2μ .”

All other claims are allowed by virtue of their dependency.

9. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled “Comments on Statement of Reasons for Allowance.”

Art Unit: 2128

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shambhavi Patel whose telephone number is (571) 272-5877. The examiner can normally be reached on Monday-Friday, 8:00 am – 4:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamini Shah can be reached on (571) 272-2279. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

SKP


KAMINI SHAH
SUPERVISORY PATENT EXAMINER